Andrew D. Mullen

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SUMMARY

- Research engineer with a background developing imaging systems and robotics for exploration.
- Over 10 years of experience on NASA and NSF projects building tools for earth and space science.
- Led the design of custom field instruments integrating optical, electrical, mechanical, and software elements.
- Member and leader of cross-functional teams conducting research in harsh polar and marine environments.

EDUCATION

2018	Ph.D.	Electrical Engineering	University of California San Diego
2015	M.S.	Oceanography	University of California San Diego, Scripps Inst. of Oceanography
2011	B.S.	Civil Engineering	University of Notre Dame, *Magna Cum Laude*

PROFESSIONAL EXPERIENCE

2023-Present	Visiting Research Scientist	Cornell University
2022-2023	Senior Research Engineer	Cornell University
2018-2022	Postdoctoral Fellow	Georgia Institute of Technology, NASA Postdoctoral Program
2019, Summer	Visiting Researcher	NASA Jet Propulsion Lab

AWARDS & HONORS

2021	Antarctic Service Medal
2018	NASA Postdoctoral Program (NPP) Fellowship
2017	Microscopy Today Innovation Award
2014	Link Ocean Engineering Ph.D. Fellowship
2013	BSF Rahamimoff Travel Grant
2013	SIO Student Excellence Travel Award
2012	NSF Graduate Research Fellowship Program (GRFP)
2011	University of California Regents Fellowship
2009	NOAA Hollings Scholarship

ENGINEERING & RESEARCH EXPERIENCE

Senior Research Engineer, Cornell University

- *Oceans Across Space and Time*: Led the development of a custom science payload for underwater robotic exploration of deep-sea brines. Served as ROV Instrumentation lead on cruise to Orca Basin brine pool in the Gulf of Mexico during summer 2023.
- *Pingo STARR*: Lead field engineer for geophysical studies of planetary analog pingo ice formations in the Arctic. Led preparation of instrumentation and field gear, conducted two weeks of field work in the Canadian Arctic.

NASA Postdoctoral Fellow, Georgia Institute of Technology (Supervisor: Dr. Britney Schmidt)

- *Icefin ROV*: Engineer on three Antarctic campaigns deploying custom underwater robot 'Icefin'. Optimized mechanical operations, coordinated vehicle launches, and troubleshot system issues. Team surveyed previously inaccessible sub-glacial ocean environments providing critical measurements for modeling sea level rise.
- *Digital Holographic Microscope (DHM)*: Led collaboration with Georgia Tech & NASA JPL developing a submersible DHM for the Icefin ROV. Instrument integrates optical, mechanical, electrical, and embedded computing elements. DHM observed microbial life in Antarctica an analog for future "ocean world" exploration.
- *Subsurface Science & Search for Life on Ocean Worlds:* Co-led design conceptual payload for future NASA mission to the moon Europa. Coordinated 21 member team, surveying state-of-the-art technologies from earth and space science. Presented framework for integrating tools into multi-sensor life-detection package.

Graduate Student Researcher, UC San Diego (Advisor: Dr. Jules Jaffe)

- *Benthic Underwater Microscope*: Jointly developed, first system to image seafloor subjects such as corals underwater at micron-scale. Payload integrates optics, illumination, focus tunable lens, and electronics into a submersible package. Applied system to study coral behavior and bleaching in natural environments.
- *Micro-Particle Tracking Velocimetry*: Enhanced underwater microscope to measure micro-scale fluid dynamics. Implemented dark-field illumination with precision timing, and developed particle tracking code. Measured viscous boundary layer surrounding coral polyps and perform Fourier analysis of fluctuating velocity fields.
- *Towed Microscope*: Engineering lead on integration and deployment of towed microscopic imaging system. Deployed system to investigate the transport and dispersion of eggs following mass Grouper spawning.

Undergraduate Student Researcher

- *Groundwater Hydrology, Benin Africa*: Conducted hydrology measurements at remote field sites to study costal saltwater intrusion. Lead small international team in field work, taught sampling methods, designed low-cost hydraulic field instruments, analyzed groundwater models. (Advisor: Dr. Stephen Silliman)
- *NOAA Hollings Scholar, University of Alaska Fairbanks*: Prepared and deployed ocean gliders and HF radars collecting data for pollution spill models in Arctic Ocean. (Advisor: Dr. Tom Weingartner)

ENGINEERING & RESEARCH SKILLS

Technical Skills

- *Software*: data analysis, image processing, computer vision, embedded systems software [*Python, Matlab]*
- *Electrical*: PCB design, implementation of embedded computers and micro-controllers [*Eagle, Python*]
- *Mechanical*: mechanical design, pressure housing design, 3D printing [*Solid Works*]
- *Optical*: imaging systems, microscopy, holography, computational imaging
- *Fluidic*: particle tracking velocimetry observations, fluid dynamics, water sampling systems

Engineering Design & Management

- *Management*: coordinated stakeholders, defined engineering requirements, managed timelines and budgets
- *Instrument Development*: performed design, procurement, fabrication, debugging, validation, and deployment
- *Systems Engineering*: integrated optical, electrical, mechanical, and software subsystems
- *Requirements*: designed systems for operation underwater, at low temperatures, in compact form factors
- *Communication*: wrote technology grant proposals, communicated results through technical papers and talks

Field Operations & Logistics

- *Planning*: collaboratively developed field objectives, mission plans, team roles, and operating procedures
- *Logistics*: coordinated international shipping, identified and acquired field operational equipment
- *Teamwork*: performed tightly coordinated team operations in dynamic environments, experienced in both support and leadership roles, member of diverse international field teams of varying size (2-20+ members)
- *Settings*: conducted research in polar, marine, and wetland environments; including isolated settings
- *Platforms*: deployed instrumentation using ROVs, research vessels, SCUBA, and snow mobile

PUBLICATIONS

Journal Publications (10)

1. SE Silliman, BI Borum, M Boukari, N Yalo, S Orou-Oete, D McInnis, C Fertenbaugh, **AD Mullen**, "Issues of sustainability of coastal groundwater resources: Benin, West Africa", *Sustainability* 2, 2652–2675 (2010). *https://doi.org/10.3390/su2082652*
2. **AD Mullen,** T Treibitz, PLD Roberts, ELA Kelly, R Horwitz, JE Smith, JS Jaffe, "Underwater Microscopy for In Situ Studies of Benthic Ecosystems", *Nature Communications* 7, 12093 (2016). *https://doi.org/10.1038/ncomms12093*
3. JD Lawrence, **AD Mullen**, FE Bryson, CJ Chivers, AM Hanna, T Plattner, EM Spiers, JS Bowman, JJ Buffo, JL

Burnett, CE Carr, DJ Dichek, KHG Hughson, W King, EG Lightsey, E Ingall, J McKaig, MR Meister, S Pierson, Y Tomar, BE Schmidt, "Subsurface Science and Search for Life in Ocean Worlds", *Planetary Science Journal* 4, 22 (2023). *https://doi.org/10.3847/PSJ/aca6ed*

4. BE Schmidt, PM Washam, PED Davis, KW Nicholls, DM Holland, JD Lawrence, KL Riverman, JA Smith, A Spears, DJG Dichek, **AD Mullen**, E Clyne, B Yeager, P Anker, MR Meister, BC Hurwitz, ES Quartini, FE Bryson, A Basinski, C Thomas, J Wake, DG Vaughan, S Anandakrishnan, E Rignot, J Paden, K Makinson, "Heterogeneous melting near the Thwaites Glacier grounding line", *Nature* 614, 471–478 (2023). *https://doi.org/10.1038/s41586-022-05691-0*
5. PED Davis, KW Nicholls, DM Holland, BE Schmidt, PM Washam, KL Riverman, RJ Arthern, I Vaňková, C Eayrs, JA Smith, PGD Anker, **AD Mullen**, DJ Dichek, JD Lawrence, MR Meister, E Clyne, A Basinski-Ferris, E Rignot, BY Queste, L Boehme, KJ Heywood, S Anandakrishnan, K Makinson, "Suppressed basal melting in the eastern Thwaites Glacier grounding zone", *Nature* 614, 479–485 (2023). *https://doi.org/10.1038/s41586-022-05586-0*
6. JD Lawrence, PM Washam, C Stevens, C Hulbe, HJ Horgan, G Dunbar, T Calkin, C Stewart, N Robinson, **AD Mullen**, MR Meister, B Hurwitz, ES Quartini, DJ Dichek, A Spears, BE Schmidt, "Crevasse refreezing and signatures of retreat observed at Kamb Ice Stream grounding zone", *Nature GeoSciences* (2023). *https://doi.org/10.1038/s41561-023-01129-y*
7. FE Bryson, ED Ingall, AM Hanna, M Cardelino, T Plattner, MR Meister, JD Lawrence, **AD Mullen**, D Dichek, BE Schmidt, "Development of the Miniature Robotic Electrodialysis (MR ED) System for Small-Scale Desalting of Liquid Samples with Recovery of Organics", *Earth and Space Science* (2023). *https://doi.org/10.1029/2022EA002620*
8. BC Stock, **AD Mullen,** JS Jaffe, A Candelmo, SA Heppell, CV Pattengill-Semmens, CM McCoy, BC Johnson, BX Semmens, "Protected fish spawning aggregations as self-replenishing reservoirs for regional recovery", *Proceedings of the Royal Society B* (2023). *https://doi.org/10.1098/rspb.2023.0551*
9. P Washam, JD Lawrence, CL Stevens, CL Hulbe, HJ Horgan, NJ Robinson, CL Stewart, A Spears, E Quartini, B Hurwitz, MR Meister, **AD Mullen**, DJ Dichek, F Bryson, BE Schmidt, "Direct observations of melting, freezing, and ocean circulation in an ice shelf basal crevasse", *Science Advances* (2023). *https://doi.org/10.1126/sciadv.adi7638*
10. T Calkin, GB Dunbar, C Atkins, A Carter, JJ Coenen, S Eaves, CE Ginnane, NR Golledge, DM Harwood, HJ Horgan, BC Hurwitz, C Hulbe, JD Lawrence, R Levy, JW Marschalek, AP Martin, **AD Mullen**, S Neuhaus, E Quartini, BE Schmidt, C Stevens, JC Turnbull, P Vermeesch, PM Washam, "Recent sedimentology at the grounding zone of the Kamb Ice stream, West Antarctica and implications for ice shelf extent", *Quaternary Science Reviews* (2024). *https://doi.org/10.1016/j.quascirev.2024.108988*

Conference Publications (7)

1. **AD Mullen**, T Treibitz, PLD Roberts, JS Jaffe, "An Underwater Microscope for In Situ Imaging of Seafloor Organism", *Optical Society of America, Novel Techniques in Microscopy 2017* (2017). *https://doi.org/10.1364/ntm.2017.ntu1c.1*
2. **AD Mullen**, DJG Dichek, JD Lawrence, MR Meister, FE Bryson, BC Hurwitz, AM Spears, PM Washam, E Quartini, BE Schmidt "A Robust Compact Water Sampler For Underwater Robotic Vehicles", *IEEE Oceanic Engineering Society, Global OCEANS 2020* (2020). *https://doi.org/10.1109/ieeeconf38699.2020.9389327*
3. M Meister, D Dichek, A Spears, B Hurwitz, F Bryson, **AD Mullen**, J Lawrence, P Washam, E Quartini, S Lopez, L Kassabian, P Anker, D Mandeno, BE Schmidt, "Antarctic Deep Field Deployments and Design of the Icefin ROV", *IEEE Oceanic Engineering Society, Global OCEANS 2020* (2020). *https://doi.org/10.1109/ieeeconf38699.2020.9389361*
4. B Hurwitz, M Thomas, JD Lawrence, P Washam, MR Meister, DJ Dichek, **AD Mullen**, AM Spears, K Haas, BE Schmidt, "CTD-on-a-Chip: High-Precision Polar In-situ Interfacial Data Collection", *IEEE Oceanic Engineering Society, Global OCEANS 2020* (2020). *https://doi.org/10.1109/ieeeconf38699.2020.9389175*
5. F Bryson, MR Meister, DJ Dichek, **AD Mullen**, BC Hurwitz, JD Lawrence, AM Spears, P Washam, ES Quartini, L Kassabian, S Lopez, BE Schmidt, "A Configurable Solid Sampling System for AUV/ROV Icefin", *IEEE Oceanic Engineering Society, Global OCEANS 2020* (2020). *https://doi.org/10.1109/ieeeconf38699.2020.9389075*
6. FE Bryson, M Nassif, PA Szot, CJ Chivers, N Daniel, BE Wiley, T Plattner, A Hanna, Y Tomar, S Rapoport, EM Spiers, S Pierson, A Hodges, J Lawrence, **AD Mullen**, D Dichek, K Hughson, MR Meister, EG Lightsey, BE

Schmidt, "Vertical Entry Robot for Navigating Europa (VERNE) mission and system design", *AIAA ASCEND 2020* pp. 4061 (2020). *https://doi.org/10.2514/6.2020-4061*

7. AJ Ramirez, BW Schierman, L Zheng, BM Dalporto, L Belvin, TP Burch, **AD Mullen**, JK Wallace, "A low-cost, submersible, digital holographic microscope for in situ microbial imaging", *Optics and Photonics for Sensing the Environment*, JTu5A. 18, (2021). *https://doi.org/10.1364/AIS.2021.JTu5A.18*

PhD Thesis

- **AD Mullen**, "Underwater Microscopic Imaging & Velocimetry for In Situ Studies of Benthic Marine Environments", University of California San Diego (2018). *https://escholarship.org/uc/item/1p03v5t1*

White Papers (2)

1. BE Schmidt, SS Johnson, T Hoehler, H Graham, J Bowman, S Som, L Barge, N Cabrol, A Pavlov, A Pontefract, A Stockton, B Orcutt, B Nunn, C Foreman, D Stillman, E Shock, F Kenig, G Love, K Bergmann, P Sobron, R Mathies, R Hatzenpichler, S Yu, W Swingley, D Jones, J Lawrence, F Bryson, E Spiers, C Chivers, T Plattner, **A Mullen**, A Hanna, J Buffo, "Enabling progress towards life detection on NASA missions", Whitepaper #260 *Planetary Science and Astrobiology Decadal Survey 2023-2032* (2020). *https://doi.org/10.3847/25c2cfeb.77a5ad8e*
2. B Schmidt, K Craft, T Cwik, K Zacny, M Smith, V Singh, B Stone, F Bryson, C Chivers, S Pierson, J Lawrence, T Plattner, E Spiers, **A Mullen**, J Buffo, N Daniel, A Hanna, G Lightsey, M Meister, M Nassif, D Dichek, A Spears, "Dive, dive, dive: Accessing the Subsurface of Ocean Worlds", Whitepaper #246 *Planetary Science and Astrobiology Decadal Survey 2023-2032* (2020). *https://doi.org/10.3847/25c2cfeb.ffef076e*

PROJECTS

Engineer and/or operational member on the following project grants:

2021-2023	"Pingo SubTerranean Aquifer Reconnaissance and Reconstruction (Pingo STARR)", NASA Planetary Science and Technology from Analog Research (PSTAR) grant, PI: BE Schmidt
2019-2023	"Oceans Across Space & Time (OAST)", NASA Astrobiology Program, Award 80NSSC18K1301, PI: BE Schmidt
2021-2022	"Unravelling the Role of Subglacial Channels in Ice Stream Evolution", NSF Office of Polar Programs grant, Award #2152742, PI: BE Schmidt
2021	"Supercooling measurements under ice shelves", New Zealand Marsden Fund grant, Award MFP-UOO1825 PI: I Smith, Co-I: BE Schmidt
2019-2021	"Vertical Entry Robot for Navigating Europa (VERNE)", NASA Scientific Exploration Subsurface Access Mechanism for Europa (SESAME) grant, Award 80NSSC19K0615, PI: BE Schmidt
2019-2020	"Melting at Thwaites Grounding Zone and its Control on Sea Level (THWAITES-MELT)", NSF-NERC Office of Polar Programs grant, Award #1739003, (International Thwaites Glacier Collaboration [ITGC]), PI: D Holland, Co-I: BE Schmidt
2018-2020	"Ross Ice Shelf and Europa Underwater Probe (RISEUP)", NASA Planetary Science and Technology from Analog Research (PSTAR) grant, Award NNX16AL07G, PI: BE Schmidt
2018-2020	"Digital Holographic Microscopy on the Icefin Underwater Antarctic Vehicle: Technology & Science Development for Icy Worlds", NASA Postdoctoral Program fellowship, Lead: AD Mullen, Advisor: BE Schmidt
2014	"A Novel In Situ Microscope for Studying Benthic Organisms", Link Ocean Engineering & Instrumentation PhD Fellowship Program, Lead: AD Mullen, Advisor: JS Jaffe
2012-2016	NSF Graduate Research Fellowship Program (GRFP) grant, Award DGE-1144086, Lead: AD Mullen, Advisor: JS Jaffe

FIELD EXPERIENCE

Certifications & Training

- SCUBA: AAUS Scientific Diver (2012), AAUS 100ft certification (2017); NAUI Advanced, Rescue, & Nitrox Diver (2012); TA Scientific Diving, SIO 130 (2017); Natural History Below the Tides, SIO 274 (2014); over 150 total lifetime dives
- Antarctic Field Training (2018, 2019, 2021): Antarctic Field Safety, Sea Ice Safety, Field Plan Risk Assessment, Snowmobile Operations, Tracked Vehicle Operations, GPS, Communication
- Medical: Wilderness EMT (2024) 200 hr emergency medicine course through National Outdoor Leadership School (NOLS)

Scientific Field Seasons

2024 Milne Fiord, Canadian Arctic (3 weeks) - Oceanographic study of glacial fiord.
2023 Orca Basin, Gulf of Mexico (2 weeks, 10 ROV dives) - ROV based study of deep-sea brine pool.
2023 Tuktoyaktuk, Canadian Arctic (2 weeks) - Geophysical surveys of pingo ice formations.
2021 Antarctic Field Season, Antarctica New Zealand (Oct-Jan):

- Kamb Ice Stream, K862 (5 weeks, 1 Icefin ROV deployments) – Exploration of subglacial channel with ROV, genomic sampling of subglacial water, geophysical surveys, operations from remote field camp.
- Scott Base, K750 (4 weeks, 5 Icefin ROV deployments) – ROV hydrographic survey of Scott Base coast.
- McMurdo Sound, K063 (3 weeks, 8 Icefin ROV deployments) – Investigation of supercooling with ROV, deployment of submersible holographic microscope, operations from containerized sea ice camp.

2021 Deadhorse, Alaska (3 weeks) – Geophysical surveys of pingo ice formations using towed instrumentation.
2019 Antarctic Field Season, US Antarctic Program (Oct-Feb):

- Thwaites Glacier, C444 (4 weeks, 5 Icefin ROV deployments) – Oceanographic exploration of Thwaites grounding zone, ROV deployments through 500m deep borehole, operations from remote field camp.
- McMurdo Station, B041 (13 weeks, 10 Icefin ROV deployments) – ROV surveys from sea ice.

2018 Antarctic Field Season, US Antarctic Program (Oct-Dec):

- McMurdo Station, B041 (9 weeks, 22 Icefin ROV deployments) – ROV oceanographic exploration of McMurdo Sound, testing of submersible water sample, operations from sea ice.

2018 Florida St. Coastal & Marine Lab (1 week) – Icefin ROV ocean testing.
2017 San Diego, California (winter quarter, 10 dives) – Teaching assistant for scientific dive course.
2017 Cayman Islands (2 weeks, 8 dives) – Small-boat deployment of towed microscope to study fish spawning.
2016 Eilat, Israel (8 weeks, 25 dives) – SCUBA study of coral micro-fluid dynamics using micro-PTV system.
2016 San Diego (3 weeks, 4 dives) – Small-boat deployments of towed microscope & smart drifters.
2016 Cayman Islands (2 weeks, 8 dives) – Small-boat deployments of towed microscope to study fish spawning.
2015 Maui, Hawaii (2 weeks, 11 dives) – SCUBA study of coral bleaching using Benthic Underwater Microscope.
2014 San Diego, California (spring quarter, 17 dives) – SCUBA based ecology field course.
2013 Eilat, Israel (9 weeks, 38 dives) – SCUBA study of coral behavior using Benthic Underwater Microscope.
2012 Palau (2012, 1 week) - Deployment & recovery of ocean gliders via small-boat.
2011-18 San Diego, California (> 6 day trips) – Research & course cruises aboard ocean research vessels.
2011 South China Sea (2011, 3 weeks) - Internal waves study aboard R/V Revelle using fast CTD casts.
2010 Barrow & Wainwright, Alaska (2 weeks) - Ocean glider and radar deployments on Arctic Ocean.
2010 Death Valley, California (1 week) - Geology field course.
2009 Benin, West Africa (4 weeks) – Collection of groundwater hydrology data in remote wetland field sites.
2008 Benin, West Africa (4 weeks) – Collection of groundwater hydrology data in remote wetland field sites.

International Collaborators

Conducted field work involving collaboration with international partners including: Antarctica New Zealand (ANZ); British Antarctic Survey (BAS); International Thwaites Glacier Collaboration (ITGC); Carleton University,

Canada; Inter-University Institute for Marine Sciences, Israel (IUI); Cayman Islands Department of the Environment; University of Abomey-Calavi, Benin

Scientific Instrumentation & Robotics Experience

- Robotics: Gained experience as member of teams using different types of ocean robotic systems to conduct marine research including a custom polar ROV (Icefin), autonomous ocean gliders (Solucm Gliders), winged towed platform (Sea Sciences Inc. Acrobat), and a commercial ROV (Global Explorer).
- Ocean Instruments, experience deploying / operating: Conductivity, Temperature, Depth (CTD); Acoustic Doppler Current Profiler (ADCP); Sonar; Chemical Sensors (Dissolved Oxygen, pH), Optical Sensors (Turbidity, CDOM), Plankton Imaging (Custom Systems), Water Sampling (Niskin Bottles, Custom),
- Geophysical Instruments, experience deploying / operating: Ground Penetrating Radar (GPR), Capacitively Coupled Resistivity (CCR), Seismic Sensors

Complimentary Recreational Field Activities

- Endurance Athletics: 2024 Ironman New Zealand (13 hr 17 min), 2024 Half Ironman Oceanside (5 hr 35 min), 2022 Ironman Arizona (12hr 47min), 2022 Half Ironman Santa Cruz (05hr 27min)
- Mountaineering: Denali, Alaska (20,310 ft), Chimborazo, Ecuador (20,549 ft), Cayambe, Ecuador (18,996 ft), Mt. Rainer 2019 (14,411'), Mt. Baker 2019 (10,786'), Mt. Whitney 2021 (14,505')
- Backpacking: section hiked over 880 miles of the Pacific Crest Trail 2021 (over approx. 7 weeks)
- Team Athletics: Univ. Notre Dame Rugby 4-year starter (2008-11), Univ. Western Australia Rugby (2009)

MENTORING & SERVICE

Teaching Assistant

- SIO 130 Scientific Diving - classroom work & ocean SCUBA sessions
- SIO 60 Experiences in Ocean and Atmospheric Sciences - classroom, lab, and field sessions including boat work
- 2017 SIO 130 Scientific Diving: Assisted the instruction of students improving their SCUBA proficiency through classroom work, practical pool, and ocean dive sessions.
- 2017 SIO 60 Experiences in Oceanic and Atmospheric Sciences: Instructed students on oceanography and atmospheric science topics through lab and field experiences including an oceanographic cruise, weather balloon launch, and several wave tank experiments.

Advising & Mentoring

- 2023 Cornell University: Mentored PhD students Alexia Kubas and Veronica Hegelein. Taught students instrument methods and supported preparations for field work. Guided student research in the field, progressively increasing student responsibilities with demonstrated success.
- 2021 University of San Diego: Mentored six-person Senior Engineering Capstone Project, "A low-cost, submersible, digital holographic microscope for in situ microbial imaging"
- 2019 JPL: Carl Snyder (Portland St. PhD student), mentored JPL summer intern who made major contributions to the submersible Digital Holographic Microscope development.
- 2017 UCSD: Adela DePavia (Yale undergraduate student), mentored Scripps Oceanography Summer Intern studying fish scale microfluidics
- 2014-2016 UCSD: Scripps Peer-Mentorship Program founding team and leadership committee member. Peer mentor for PhD students Ludovic Tenorio and Madeleine Harvey.

Service

- Proposal reviewer: NASA PICASSO, NASA FINNEST
- Community Workshops: Future of the Search for Life (FoSL) Science and Engineering Workshop (2022)

MEDIA & OUTREACH

Media

• Research has been covered by: BBC Frozen Planet II (documentary), NY Times (featured video), Nature (research highlight), Physics Today (magazine cover), Scientific American (magazine article), Popular Mechanic (magazine article), LA Times, Washington Post, Wall Street Journal, PBS, BBC, National Geographic, WIRED, MIT Technology Review, and more – full list at https://andrewdmullen.github.io/media/
• Communicated with the media through video interviews, phone calls, and written communications.

Outreach

• 2023 Tuktoyaktuk: Demonstrated pingo survey methods and results to local native Inuvialuit students.
• 2018-23 Icefin Tours: Provided tours and descriptions of the Icefin robot as a member of the vehicle team to a variety of audiences including McMurdo Station Staff, Scott Base Staff, National Science Foundation representatives, university faculty, students, and others.
• 2011-18 Student Cruises: Demonstrated Jaffe Lab "3D Plankton Microscope" to undergraduates on a number of day long cruises which I volunteered for aboard the R/V Sproul & R/V New Horizon
• 2016 Birch Aquarium: Research images featured in permanent exhibit on coral bleaching; developed temporary coral activity station 'Life of a coral, at the microscale!'
• 2016 Coursework: SIO 180 'Communicating Ocean Science to an Informal Audience'

CONFERENCES & SEMINARS

Invited Talks

1. **AD Mullen**, "Microscopes for Life Detection And Exploration: From Oceans To Space", *Network for Life Detection (NFOLD) Seminar*, Virtual (Oct 2020).
2. **AD Mullen**, "Microscopes for Earth & Space Exploration" *Georgia Tech Planetary Science & Astrobiology Seminar*, Atlanta, Georgia (Sept 2020).
3. **AD Mullen**, "Adventures with Underwater Microscopes: From the Tropics to the Poles", *Crary Library*, McMurdo Station, Antarctica (Oct 2019).
4. **AD Mullen**, "Microscopic Imaging of Coral & Fluid Motions", *SIO/SDSU Coral Club*, San Diego, California (Apr 2018)
5. **AD Mullen**, JS Jaffe, "Adventures in Underwater Microscopy." *Optical Society of America, Applied Industrial Optics*, San Francisco, California (June 2017).
6. **AD Mullen**, T Treibitz, PLD Roberts, JS Jaffe, "An Underwater Microscope for In Situ Imaging of Seafloor Organism." *Optical Society of America, Novel Techniques in Microscopy*, San Diego, California (April 2017).
7. **AD Mullen**, "Benthic Underwater Microscope," *Scripps Institution of Oceanography*, La Jolla, California (May 14).
8. **AD Mullen**, "In Situ Coral Microscopy," *Interuniversity Institute of Marine Sciences*, Eilat, Israel (Jan 2014)

Workshops & Conferences

• 2022 Future of the Search for Life (FoSL) Science and Engineering Workshop
• 2022 Astrobiology Science Conference, AGU
• 2020 AGU Fall Meeting, AGU
• 2020 Global OCEANS, IEEE
• 2019 Astrobiology Science Conference, AGU
• 2019 Forum for Research into Ice Shelf Processes (FRISP)
• 2019 Microscale Ocean Biophysics
• 2018 Ocean Sciences, AGU
• 2016 Microscale Ocean Biophysics
• 2014 Ocean Optics XXII
• 2014 Scripps Student Symposium

Conference Presentations & Abstracts

2024

1. ER Paris, ER Bowman, ED Ingall, PT Doran, M Desmarais, C, Elbon, JB Glass, S Buessecker, C Pozarycki, J McKaig, V Hegelein, M Meister, **AD Mullen**, C Sephus, E Quartini, B Schmidt, AE Dekas, "Rates of autotrophy peak in the anoxic interface of a deep hypersaline anoxic basin", *2024 Goldschmidt* Conference (2024).
2. B Schmidt, J Lawrence, M Meister, FE Bryson, A **Mullen**, C Chivers, E Spiers, S Pierson, P Washam, V Hegelein, D Lein, "Beyond the Borehole: Technology and Science Recommendations for Ocean World Missions Based on Antarctic Robotic Campaigns", *2024 Astrobiology Science Conference* (2024).
3. C Pozarycki, L Kivrak, M Castillo, AJ Williams, T Gibson, JS Bowman, SM Som, ER Paris, S Buessecker, L Fisher, M Desmarais, MM Weng, A Odenheimer, V Hegelein, M Meister, **A Mullen**, E Quartini, C Sephus, AT Schartup, B Klempay, DH Bartlett, ED Ingall, J Weber, T Plattner, M Birmingham, CE Elbon, JM McKaig, C Ross, PT Doran, B Schmidt, AM Stockton, "Biosignature Organics in Hypersaline Analogs: Obstacles and Insights for in situ and Returned Sample Analyses." *2024 Astrobiology Science Conference* (2024).
4. JS Bowman, DH Bartlett, S Buessecker, AE Dekas, CE Carr, M Desmarais, P Doran, CE Elbon, L Fisher, JB Glass, Veronica Hegelein, ED Ingall, E Kann, B Klempay, JM McKaig, M Meister, **A Mullen**, ER Paris, C Pozarycki, E Quartini, C Ross, RR Salcedo, AT Schartup, P Schless, C Sephus, E Skoog, SM Som, AM Stockton, M Tfaily, H Wolf, B Schmidt, "Habitats and Life in Orca Basin: a low temperature, low water activity, low energy analog environment", *2024 Astrobiology Science Conference* (2024).
5. CE Elbon, M Desmarais, C Pozarycki, ER Paris, JM McKaig, S Buessecker, C Sephus, C Ross, E Quartini, ED Ingall, JS Bowman, DH Bartlett, B Schmidt, JB Glass, V Hegelein, M Meister, **A Mullen**, "Anaerobic biological formation of manganese oxides in the Gulf of Mexico deep hypersaline anoxic basin", *2024 Astrobiology Science Conference* (2024).
6. JH Bradford, M Siegfried, V Follingstad, K Hughson, A Routt, B Schmidt, A Kubas, E Quartini, **A Mullen**, A Swidinsky, "Mapping the internal structure Arctic pingos using ground-penetrating radar: Results from the Pingo Canadian Landmark" *Seventh International Conference on Engineering Geophysics*, Society of Exploration Geophysicists (2024). *https://doi.org/10.1190/iceg2023-023.1*

2023

7. V Follingstad, RJ Michaelides, M Siegfried, K Hughson, J Bradford, A Kubas, E Quartini, **A Mullen,** A Routt, B Schmidt, HG Sizemore, A Swidinsky, "Quantifying the Surface Deformation of Pingos on the Alaskan North Slope using Interferometric Synthetic Aperture Radar (InSAR)", *AGU Fall Meeting Abstracts 2023* (2023). Bibcode: 2023AGUFM.C53C.106F
8. A Kubas, A Routt, K Hughson, M Siegfried, J Bradford, V Follingstad, **AD Mullen,** A Swidinsky, E Quartini, HG Sizemore, RJ Michaelides, B Schmidt, "Exploring Alien Ice Hills: Terrestrial Pingos as Analogs for Planetary Hydrology", *AGU Fall Meeting Abstracts 2023* (2023). Bibcode: 2023AGUFMEP33B04K
9. V Hegelein, P Washam, B Schmidt, J Lawrence, E Quartini, MR Meister, FE Bryson, A Mullen, "Water Column Properties and Ice-Ocean Interactions Beneath Erebus Glacier Tongue, Antarctica", *AGU Fall Meeting Abstracts 2023* (2023). Bibcode: 2023AGUFM.C13C1131H
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